# AN INTEGRATED APPROACH TO WILDLIFE DAMAGE MANAGEMENT IN HYBRID POPLAR PLANTATIONS

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## ABSTRACT

Wildlife damage to hybrid poplar plantations can pose a serious threat to the economical production of short-rotation wood fiber. Many species of wildlife have the potential for causing damage through their foraging activities, including rodents, lagomorphs, ungulates, and coyotes. Integrated Pest Management (IPM) concepts can be used to successfully manage wildlife damage to hybrid poplar plantations within economic thresholds. Practices such as monitoring, determination of economic threshold, and using a combination of control methods are necessary in order to effectively manage wildlife damage on a large scale.

**Keywords:** wildlife damage, hybrid poplar, integrated pest management, IPM

## INTRODUCTION

The potential for hybrid poplars (*Populus* spp.) to produce large amounts of biomass in a relatively short rotation period has resulted in extensive efforts by several companies to establish managed plantations in the Pacific Northwest (Heilman et al. 1995). Initial start-up costs, as well as maintenance of these often high-tech operations are very expensive. In order for these operations to prove profitable, the cost of producing poplar fiber must be kept to a minimum.

Wildlife damage to hybrid poplar plantations is a serious threat to the economical production of short-rotation wood fiber. Many species of wildlife have the potential for causing damage through their foraging activities, including rodents, lagomorphs, and deer. Damage to plantations can range from minimal and localized, as can be the case with animals such as porcupines (*Erethizon dorsatum*) (Hygnstrom et al. 1994; Eglitis and Hennon 1997), or severe and widespread, as is often the case with voles (*Microtus* spp.) during population irruptions (Bowersox 1973; Hunter and Tukey 1985; Askham 1988; Sullivan and Sullivan 1988; Sullivan and Martin 1991). An effective management strategy must be in place in order to address wildlife damage issues at all scales on hybrid poplar plantations.

Integrated Pest Management (IPM) can be used to effectively manage wildlife damage in hybrid poplar plantations. IPM can be defined as:

> A systematic approach to crop protection that utilizes regular monitoring and economic thresholds to determine if and when treatments are needed. When control is necessary, all practical control methods are employed, including biological, chemical, physical, cultural, and genetic, in a way that minimizes economic and environmental risks and optimizes production (Allen and Rajotte 1990; Olkowski et al. 1991).

The goals of IPM are to optimize growth and yield of plantations, reduce operating costs, and minimize hazards to the environment. Keys to successful implementation of an IPM program include pest population and damage monitoring, economic thresholds, and the integration of various control techniques.

Monitoring pest populations and damage on a regular basis is essential in order to minimize the occurrence of large-scale damage problems on plantations. Monitoring methods should be standardized so that meaningful comparisons can be made on both a temporal and spatial scale across the plantation. It is not always necessary to obtain an absolute estimate of the pest population. Often a population index can be used to evaluate the potential risk of a plantation to wildlife damage. This approach allows the manager to anticipate a developing situation and to respond before substantial losses have occurred or are unavoidable.

Data on tree damage needs to be collected in conjunction with population monitoring. This allows for the determination of an economic threshold, which is the point at which the benefits of controlling wildlife damage outweigh the costs of implementing the control methods. It is important to determine the economic threshold in each damage situation in order for an IPM program to meet the goals of optimizing economic returns while minimizing hazards to the environment. For example, it is generally not cost effective nor environmentally sound to apply rodenticides to an entire field when damage has been found on only one or two trees. A more effective approach might be to trap out the individual(s) causing the damage, or to apply rodenticides by hand to the area being damaged. Monitoring pest populations and damage is especially important in crops that require many years before a profit is realized.

When it is deemed that control is necessary, an integration of several applicable control methods is often the most effective approach to reducing wildlife damage in an economically and environmentally sound manner. For example, rodent management in orchards is most often successful when rodent populations are monitored, ground vegetation cover is carefully managed, and rodenticides are judiciously applied. Additionally, in these times of socio-political uncertainties, the manager cannot assume that a method that is effective and readily available will remain available for future use. Pest control methods can be categorized into five broad categories: 1) physical, 2) cultural, 3) chemical, 4) biological, and 5) genetic.

## CONTROL TECHNIQUES

### Physical Control

Physical control relies on either a physical barrier to deter animals from feeding on the tree, or removal of the animal by hunting or trapping. Examples of physical barriers include plastic tubing, aluminum foil, and fencing. Physical barriers are often labor intensive and costly to implement, and therefore should be used only on trees that are of high value and that cannot be protected in any other way. Hunting and trapping can also be effective methods of population control in certain circumstances. One needs to be aware of the state and local regulations on hunting and trapping.

### Cultural Control

Cultural control is defined as any method that manipulates wildlife habitat within and around the plantation. This includes the use of cultivation, herbicides, burning, and providing alternative foods (Sullivan and Sullivan 1988). Vegetation control is probably the most important means of vole management, especially in orchards or forestland (Spencer and Barrett 1980; Davies and Pepper 1987; Godfrey and Askham 1988; Hygnstrom et al. 1994). Voles will usually thrive in any environment where heavy vegetative cover, especially grasses and forbs, abound. This is because voles rely on grasses and forbs as food and cover during most of the year. Any effort to reduce ground cover usually results in a reduction of the vole population. Many rodent species thrive in early successional (grass and forb) settings. Population densities usually decline substantially once the tree canopy closes and the ground cover of grasses and forbs declines.

### Chemical Control

Chemical control includes both toxic pesticides as well as repellents. Generally, toxicants are only available for control of rodent pests: their use for carnivores and rabbits and hares is much more restricted (Hygnstrom et al. 1994). Zinc phosphide is a commonly used acute toxicant for vole control, although some chronic (anticoagulant) toxicants are also available. A number of repellents are registered for use on trees to deter a variety of wildlife pests. These repellents may act as contact repellents, which are applied to individual trees and give off a noxious odor or taste, or can be area repellents such as predator odors, which are intended to repel animals from entire fields. Although a lot of repellents have been registered, very few work well under adverse environmental conditions, and many are costly to apply on a large scale. They are most effective when there is a narrow time window of damage, such as with migrating animals or when trees only need protection for a short time period. Again, one needs to be aware of the federal, state, and local regulations on pesticides.

### Biological Control

Biological control is the use of naturally-occurring agents to reduce wildlife pests. Examples include predators, parasites, and diseases. This form of control is most commonly applied to insect pests. Although biological control may reduce densities of some wildlife populations (Korpimaki et al. 1991), it is unlikely that biological controls will always maintain prey populations below damage threshold levels. Using biological controls usually means encouraging predators by provision of habitat elements such as raptor perches and nest boxes (Askham 1990), and by protecting them (i.e., coyotes) from hunting.

### Genetic Control

Genetic control is defined as using specific planting material that is naturally resistant to herbivores. Studies have shown that some tree species and certain clones are naturally resistant to mammalian herbivores (Jogia et al. 1989; Bucyanayandi et al. 1990; Hansson 1994; Bergeron et al. 1998). Tree species and varieties within species often differ in their chemical composition of secondary compounds, which are used as a natural defense against herbivores (Bucyanayandi et al. 1990).

Secondary compounds are often found at different levels in trees depending on the species, geographical origin, and/or clone (Jogia et al. 1989; Hansson 1994). Identification of planting material that has relatively high levels of secondary compounds would be advantageous in the fight against mammalian herbivores. In addition, it may be possible to transfer the genes responsible for the production of secondary compounds from one tree to another using advanced genetic engineering techniques (Jermy 1990). Although a tremendous amount of genetic work has been conducted on *Populus* spp., very little has examined the potential to breed clones for wildlife foraging resistance. Nevertheless, some clones appear to be less palatable to deer, elk, and voles (Don Rice, personal communication) in field observations.

## WILDLIFE DAMAGE

A number of species of wildlife can cause damage to hybrid poplar plantations, primarily because of winter and early spring foraging activities when non-woody forage alternatives are limited. It is important for managers to be aware of 1) the wildlife species that may occur on the plantation, 2) the types of damage caused by some of those species, 3) how to monitor populations and damage, and 4) when and how to apply damage management techniques. An IPM damage management strategy should be developed and implemented. The strategy should target the species causing the damage, include a thorough assessment of the situation and knowledge of the species' biology and ecology, use legal as well as socio-politically acceptable methods, minimize hazards to non-target species and the environment, and include feedback or reassessment steps to assure success of the strategy or to revise it as needed.

Specific information on wildlife species that commonly cause damage to hybrid poplar plantations in the Pacific Northwest are presented in Table 1. [For more details, see Black (1992); Hygnstrom et al. (1994); Nolte and Otto (1996); or Sullivan (Undated).] It is important to note that a plantation can be characterized by a set of damage risk factors, some of which can be controlled or manipulated by the manager before planting, during growth, and after harvest of stands. Damage reduction methods vary in effectiveness, durability, cost, maintenance, and other attributes. For example, fencing animals out of an area can have high initial costs, but can resolve a damage situation, with some maintenance effort, for decades. A few general comments on each of the species groups follow.

Table 1.— Types of damage, monitoring techniques, and damage reduction methods for certain groups of wildlife known to cause damage in hybrid poplar plantations. See text for references providing more details.

| Species | Damage Type | Monitoring | Cultural Methods | Physical Methods | Chemical Methods | Biological Methods |
|---|---|---|---|---|---|---|
| Voles | bark/root gnawing | trap grid, apple chunks | grass/forb control, veg. ht. control | tree guards, snap traps | rodenticides | raptor perches, nest boxes |
| Pocket gophers | bark/root/tube gnawing, stem clipping | mound counts | grass/forb control | kill traps | rodenticides (in burrows) | raptor perches, nest boxes |
| Porcupines | bark gnawing, stem clipping | spotlight counts | - | leghold traps, shooting | - | - |
| Rabbits | bark gnawing stem clipping | pellet group counts, spotlight counts | vegetation, slash, brush control | fencing, tree guards, live traps, shooting (*where legal*) | repellents, anticoagulants | raptor perches, nest boxes |
| Deer/elk | stem browsing, antler rubbing | pellet group, track, or spotlight counts | lure crops | fencing, tree guards, frightening devices, shooting | repellents | - |
| Coyotes | irrigation tube chewing | track counts | - | fencing, frightening devices, leghold traps, shooting | toxicants (M-44, *where legal*) | - |

## Voles (*Microtus* spp.)

Voles are small rodents that are often called meadow mice because they thrive in grass-forb habitats. They live in shallow, open burrow systems and the golf-ball-sized openings are usually connected by many runways that are about 2 inches (5.1 cm) wide. Close examination will often reveal clipped grass and very small fecal pellets. Voles are active year around and damage woody vegetation in winter and early spring by gnawing through bark at the base of the tree or below ground. The patches of missing bark appear fuzzy because of the small teeth marks coming from many different angles. Vole populations are cyclic with high densities occurring every 3–5 years at which time damage can be severe.

## Pocket gophers (*Thomomys* spp.)

Pocket gophers are small, fossorial rodents living in closed burrow systems in grassy-forb areas and early stages of reforestation. Clusters of earthen mounds are evidence of their presence. They are active year around and can damage woody species by gnawing on roots, by girdling stems near the surface, or by clipping small-diameter stems and lateral branches. Gophers also gnaw through buried cables and drip irrigation tubing. Even when gophers are removed from an area (usually by the use of toxic baits or kill traps placed in burrows), rapid reinvasion occurs in good habitat; hence, constant vigilance and retreatment are usually required.

## Porcupines (*Erethizon dorsatum*)

Porcupines are large rodents that usually occur in low densities and only occasionally cause serious problems in forestry. They are active year around and a small number of them can cause localized damage in winter when alternative forage is not available. They will often damage trees over a number of years, gnawing through patches of bark in the mid- to upper-boles and sometimes completely girdle trees in those areas. They can also debark the bases of seedlings and small saplings. Sizeable teeth marks can be observed with porcupine damage. Bark chips and oblong fecal pellets are also evidence of their presence. While fewer methods are available for management of this rodent, the lower densities usually make control easier.

## Rabbits (*Sylvilagus* spp.) and Hares (*Lepus* spp.)

Rabbits and hares, collectively called lagomorphs, can cause tree damage in winter by clipping small stems and laterals with a sharp, oblique cut. Groups of circular, particle-board-like fecal pellets are evidence of lagomorph presence. Lagomorphs require patches of dense brush or vegetation (alive or dead) for hiding cover from predators. Snowshoe hare populations are cyclic with high densities occurring every 9–11 years.

## Deer (*Odocoileus* spp.) and Elk (*Cervus elaphus*)

Deer and elk are large ungulates that can cause substantial damage to trees by browsing lateral branches and terminals, especially in winter and spring. Males may also damage saplings by antler polishing during the late summer and fall rut. The protective cover of hybrid poplar plantations can be especially attractive to deer in semi-arid regions such as the interior Pacific Northwest. The tracks and fecal pellets of deer or elk are evidence of their presence. Lacking upper incisors, these ungulates also leave rather jagged breaks on stems when foraging. Deer and elk population densities are usually carefully regulated by state wildlife agencies through hunting seasons, but these agencies will often allow "hot spot" hunts or will issue "kill permits" where agricultural damage is especially severe.

## Coyotes (*Canis latrans*)

Coyotes and other predators are known to provide a service by consuming rodents and lagomorphs. In some hybrid poplar plantations, however, they have caused substantial damage by chewing on drip irrigation tubing. They may be attracted by the water itself, or by the nutrients in that water. Coyotes are very adaptable and can occur at relatively high densities where adequate prey base and cover are available.

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